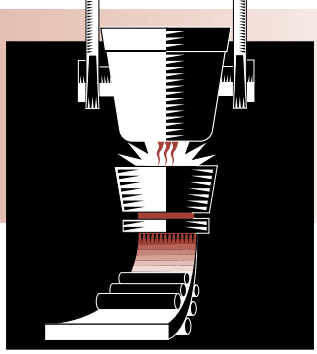
STEEL

Project Fact Sheet



Study of Deformation Behavior of Lightweight Steel Structures Under Impact Loading

Benefits

- Provide tools that can be used for evaluation of the deformation behavior of lightweight steel structures under impact loading
- Evaluation of steel processing technologies and identification of areas of design improvement
- Minimization of the number of physical structures that need to be built to improve design concepts, thus saving manufacturers time and money
- Establish the competitive advantage of steel by demonstrating the advantages of lightweight steel designs
- The lightweight steel auto structures that will be enabled by this study will save .37 quad of energy in the year 2020

Applications

The models, analytical techniques and tools resulting from this study will allow comparison of the deformation behavior of lightweight steel structures with the structures in existing fleet cars and with structures incorporating alternative materials. It will also be possible to incorporate different material processing technologies and some design modifications and evaluate their deformation performance. Use of these tools could accelerate the development of lightweight steel autobodies.

Study will provide tools to evaluate the deformation behavior of lightweight steel structures under impact loading

Oak Ridge National Laboratory (ORNL), in conjuction with the American Iron and Steel Institute (AISI) and its partners, is using computational modeling to develop tools to analyze the deformation behavior of lightweight steel vehicles.

The next generation of vehicles will have to be significantly lighter in order to meet the fuel efficiency requirements. The real challenge of reducing vehicular weight is to maintain and improve performance compared to current designs while ensuring safety standards and affordability. Although major efforts are underway to replace steel as the main structural material, alternative materials must overcome obstacles such as cost, ease of manufacture and applications, and durability, before they can become a viable alternative to steel. An alternate approach is to use improved steels and advanced steel forming technologies coupled with innovative designs, such as done by the Ultra Lightweight Steel Auto Body Consortium. The models and analytical techniques developed will provide a comprehensive tool that the steel industry and its partners can use to improve designs for lightweight steel vehicles.

Ultra Light Steel Auto Body

An alternative approach to lightweight vehicle design using advanced steel processing and design technologies.

Project Description

Goal: To develop computational tools that will accelerate the development and introduction of lightweight steel automotive structures by using advanced computational simulations to assess integrated design and performance under impact loading conditions.

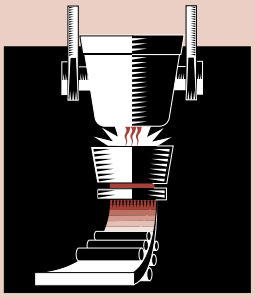
Initial activities will evaluate the modeling capabilities of ORNL with information from the Ultra Lightweight Steel Auto Body-Porsche study. Other Phase 1 activities will focus on establishing a partnership that will define a set of parameters to be analyzed to assess and demonstrate the advantages of lightweight steel designs.

The second phase of the project will perform detailed computational analyses of the situations defined in Phase 1. These situations will involve existing ultra lightweight steel and other auto body designs.

The project's final stage is to document developments and findings in a manner that will allow for simple modification and analysis.

Progress and Milestones

- Developed stain-rate dependeant material models for high-strength steels used in the ULSAB lightweight steel vehicle design.
- Devloped ULSAB crash model that incorporates steel strain-rate effects.
- Investigated the influence of material modeling on crash response.
- Developed models for incorporation of forming processes into the crash models.
- Developed ULSAB model that incorporates material processing into the crash model.
- Analyzed and evaluated the effect of forming processess on vehicle crash performance.
- Analyzed crash compatibility of the ULSAB with the existing vehicles of the same size.
- Published developments and findings in conference proceedings.



Project Partners

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